apparatus consisting of thin plate orifices, large connecting boxes and delicately poised vanes, is figured and described by which the fundamental pneumatic laws may be demonstrated. For example, if H be the head or aëromotive force, R the resistance, or sum of resistances, and V the volume of air delivered, using comparable units, the relation $H=RV^2$, corresponding with Ohm's law $E=RC$, is shown to exist.

The book is divided into three chapters comprising respectively 26, 19, and 33 pages. The first deals with the laws of flow in air circuits and their verification, in the manner already referred to. The second with the physical principles applicable to the ventilated space, in which the important effects of changes of temperature and the convection currents resulting therefrom are discussed, and some sketches of delicate and simple apparatus used by the author in his investigations, together with some real and ideal thermal diagrams, are given. In the third chapter are discussed the essentials for practical ventilation, and, so far as the limits of the book permit, the various systems in general use. Here again the electrical analogy is given full play, and applied to the consideration of the open fire, the cowl, the vacuum and plenum systems, and to simple cross-ventilation.

The diction throughout the book is so clear and concise that we cannot even quarrel with Dr. Shaw when he refers to a draught along the floor as likely to set up "the reversed correlative of the therapeutic action" of putting one's feet in water, and we heartily endorse his suggestion that this important subject should receive more attention at the hands of those engaged in scientific research in our technical institutions.

OUR BOOK SHELF.

The Aim and Achievements of Scientific Method: an Epistemological Essay. By Dr. T. Percy Nunn. Pp. x+144. (London: Macmillan and Co., Ltd., 1907.) Price 3*s.* 6*d.* net.

THIS essay is an expansion of a paper read before the Aristotelian Society in February, 1906, and was in its present form printed in September, 1906, and presented to the University of London as a thesis for the degree of Doctor of Science. The results described were reached in the course of a study of the problems of science teaching in schools, but its pedagogical applications are not considered in the present volume.

The essence of the doctrine presented by the author is the view that a large part of the contents of our consciousness from moment to moment consists of elements which exhibit themselves as having a certain unique "priority" to our conscious processes. These elements constitute what he describes as the objective. The aim of the scientific process is to render objective facts intelligible to an individual consciousness by building up the primary facts into "secondary constructions" by means of ideas drawn from other contexts of experience. No hypothesis is considered essentially incapable of making primary facts intelligible on the ground of the context of experience from which it is drawn, while the hypothesis is in no case to replace (in the sense of accounting for the "reality" of) the objective facts which it has been employed to render intelligible. The extent to which unification of the various provinces of scientific inquiry can be brought about is identical with the range over which hypotheses drawn from a single context of experience can be applied to illustrate facts.

The author examines briefly the most systematic of the attempts that have been made to render the whole range of sensible facts intelligible by means of the concepts of "mass" and "motion," which are themselves drawn only from one province of primary facts. Huygens, in his discussion of the collision of elastic bodies, made use of what Mach calls an "instinctive perception," that the centre of gravity of a system left to itself cannot rise; this was by the Bernoullis developed into the principle of *vis viva,* upon which Helmholtz based his wider principle of the conservation of energy, which first brought the facts of heat into a line with those of mechanics. But though temperature changes are thus connected with mechanical facts, the doctrine does not effect a reduction of the former to the latter, nor is Lord Kelvin's absolute thermodynamic scale more successful, as it makes no attempt to deduce from dynamical data the experiences to which the notion of temperature refers. Even the theory of Helmholtz is only partially successful. The modern science of energetics expressly declines to attempt to explain one set of objective phenomena in terms of another, contenting itself with trying to bring physical facts into a form of unity without reducing them to one type. In doing so it exhibits a practice that accords with the philosophical tenets of Dr. Nunn's essay. The hypothesis has, as he shows, merely a transient function, to point the way to new facts, including relations between things, and should then efface itself.

The Principles and Practice of Brewing. By Dr. Walter J. Sykes. Third edition, revised by the author and Arthur R. Ling. Pp. xviii+588; illustrated. (London: C. Griffin and Co., Ltd., 1907.) Price 21*s.* net.

THE publication of a new edition of this well-known book, which has been thoroughly revised by its author, the late Dr. Sykes, in conjunction with Mr. Ling, and brought well up to date, should be welcomed by all interested in the scientific aspect of the brewing industry. In one respect we think the late author and his colleague have lost an opportunity in not revising the original plan of the book, together with the matter it contains, for we have always considered that the book suffered to some extent in usefulness from the manner in which it was arranged; but, however this may be, the work in its present form stands easily first among books in our language devoted to a consideration of the complex scientific problems underlying the brewer's art.

The present edition, like the previous ones, is essentially a treatise on the scientific principles which underlie brewing technology, and although the word "practice" is included in its title, the space actually devoted to a description of the various processes of brewing and malting is comparatively small. In a book which deals in a somewhat encyclopædic manner with many different branches of science, naturally some unevenness is noticeable in the treatment of the various subjects included, but none of the more recent investigations of importance which bear on the subjects discussed appears to have been overlooked, and the references which are given add much to the value of the book. The strongest part of the book is undoubtedly the one which deals with the chemistry of the carbohydrates, more especially the chemistry of starch, and the author's *résumé* of the investigations which have been made in this country and abroad in connection with the transformation of starch by diastase is the most complete account of the subject

we have yet seen. We recommend the book not only to those directly interested in the scientific aspect of brewing, but also to those chemists and biologists whose work in any way trends in the direction of brewing or malting problems.

Oberharzer Gangbilder. By Dr. Phil. B. Baumgärtel. Pp. 23+six plates. (Leipzig: Engelmann, 1907.) Price 7 marks.

THE text of this book describes the geological features of the Upper Harz, and the mineral veins that, according to von Koenen, were injected into the old rocks of the region as recently as Miocene times. It serves as an introduction to six very beautiful photographs of large rock-surfaces in the mines. The various minerals of the lodes have been coloured in effective but harmonious tints, so that the relations of each can be traced out precisely. This combination of photographic accuracy with diagrammatic clearness may serve as a model for reproductions in other branches of science. The old coloured geological landscapes of the days of Weaver and Delabeche occur to one's mind, and might thus with advantage be revived.

G. A. J. C.

LETTER TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

Atmospheric Absorption of Wireless Signals.

IN the *Electrical Review*, May 11 and 18, the writer has given curves which show that telegraph messages exchanged between Scotland and Massachusetts are received on some nights with practically no absorption, while on other nights and in daytime nine hundred and ninety-nine one-thousandths (0·999) of the energy is absorbed.

The fact that the daylight absorption was largely reduced between two stations 150 miles apart in Brazil by the use of a longer wave-length suggested that the masses of ionised air which are supposed to produce the absorption are broken up somewhat as clouds are. During the past six months experiments have been made between Massachusetts and stations at Porto Rico, Cuba, Washington (D.C.), and New York which seem to point to the same conclusion.

Two types of transmitting apparatus were used.

The first was an alternating-current dynamo giving 250 sparks per second and generating feebly damped waves. The energy used was between 10 and 12 kw., and the frequencies used were 200,000 per second and 81,700 per second.

Messages sent with the higher frequency from Massachusetts were received very strongly at night-time at Porto Rico and Cuba, and were officially reported on several occasions as having been received by naval vessels in the neighbourhood of Alexandria, Egypt (a distance of nearly 4000 miles), but no messages were received during daytime. The absorption comes on very suddenly, and in the West Indies increases sometimes nearly a thousand-fold in fifteen minutes as the sun rises.

With the longer frequency, however, though at night signals were considerably weaker, probably on account of the receiving stations not being adapted for such a long wave-length, the daylight signals were many times stronger, and it was found possible to work in daylight between Massachusetts and Cuba (a distance of nearly 1700 miles) when using the lower frequency without any increase in sending power. Tests between Boston and Washington now continuing for nearly six months show the same phenomena, *i.e.* that there is great daylight absorption at a frequency of 200,000, but almost no absorption at a frequency of 81,700.

The second type of apparatus used consisted of a high-frequency alternator capable of giving a frequency of 100,000, but for the purposes of this test run at a frequency of 81,700. The open-circuit voltage at this frequency is 150 volts, and its armature resistance six ohms. This apparatus is used for telephoning wirelessly between Brant Rock, Massachusetts, and the City of New York. A detailed description of a similar but less powerful apparatus used for telephoning between Brant Rock and Plymouth, Massachusetts, will be found in the *Electrical Review* of February 15, 22, and March 1, and in the *American Telephone Journal* of January 26 and February 2. The current used in the antennæ is from four to six amperes, and the speech received by the New York station is approximately five or six times louder than the limit of audibility. Tests have now been made with this apparatus over a period of nearly a month, wireless telephonic communication having been first established between these points about July 17. While this apparatus has not been tested for so long a period as the former type, the results obtained are in substantial agreement.

If the masses of ionised air were continuous there is no apparent reason why there should be less absorption with a long wave-length. The above experiments seem to point to the conclusion that the masses of ionised air which are supposed to produce the absorption are not continuous but are broken up in somewhat the same manner that water vapour is into clouds.

The fact that the wave-lengths must be increased as the transmission distance is increased in order to overcome the absorption does not necessarily indicate that the masses are of larger size as the distance above sea-level increases, though it is possible that this is the case.

The writer has found that the absorption at night-time varies with the direction from which the waves are received, and has obtained some results which seem to indicate that measurements of this phenomenon may have a meteorological value, and may assist in extending the range of weather forecasts.

REGINALD A. FESSENDEN.

Brant Rock, Mass., August 9.

PRACTICAL TELEPHOTOGRAPHY.

EARLY in 1881 I described in NATURE (vol. xxiii., p. 334) an experimental apparatus for the electrical transmission of pictures to a distance, in which use was made of one of the sensitive selenium cells devised a few months previously (*ibid.*, p. 58). Fig. 1 shows the arrangement diagrammatically. The transmitting cylinder T is mounted upon a screwed spindle, which moves it laterally through 1/64 inch at each revolution; a selenium cell S is fixed behind the pinhole H, 1/20 inch in diameter, and is electrically connected through the spindle with the line wires L, E; the picture to be transmitted—about two inches square—is projected upon the front surface of the cylinder by the lens *l*. The brass receiving cylinder R is of the same dimensions as T, and is similarly mounted; F is a platinum stylus, which is pressed vertically against the metal by the flat spring G; W is a variable resistance, and B_1, B_2 are batteries at the transmitting and receiving stations respectively. A piece of paper moistened with a solution of potassium iodide is wrapped round R, and, the pinhole H having first been brought to the brightest part of the focussed picture (thereby reducing the resistance of S to its minimum value), the resistance W is adjusted so that no current passes along the "bridge" C D, which, assuming the two batteries to be equal, will be the case when the resistance of W is the same as that of S. If now the Se cell is darkened, its resistance will be increased and a current will pass through the receiver in the direction C D, liberating iodine at the point of the stylus F.

To transmit a picture, the two cylinders are caused to rotate synchronously, at the same time moving from end to end of their traverses; in the course of